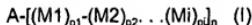


WHAT IS CLAIMED IS:

1. A polymer having a star structure chosen from structures of formula (I):



in which:

A is chosen from polyfunctional centers having a functionality n;

$[(M1)_{p_1}-(M2)_{p_2} \dots (M_i)_{p_i}]$ represents a branch comprising at least one polymerized monomeric unit M_i having a polymerization index p_j ;

n is an integer greater than or equal to 2;

i is greater than or equal to 2;

p_j is greater than or equal to 2;

said at least two branches may be identical or different; and

said at least two branches are grafted covalently to A;

wherein said at least one polymerized monomeric unit M_i comprised by at least one of said at least two branches is chosen from polymerized monomeric units M_k , which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units M_k has a T_g of greater than or equal to 10°C;

wherein said at least one polymerized monomeric unit M_i contained by at least one of said at least two branches is chosen from polymerized monomeric units M_j ,

which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units M_j has a T_g of less than or equal to 10°C;

wherein said at least one polymerized monomeric unit M_i chosen from polymerized monomeric units M_k is present in an amount ranging from 55 to 95 percent by weight relative to the total weight of the polymerized monomeric units M_i ; and

wherein said at least one polymerized monomeric units M_i chosen from polymerized monomeric units M_j is present in an amount ranging from 5 to 45 percent by weight relative to the total weight of the polymerized monomeric units M_i .

2. A polymer according to claim 1, wherein said homopolymer formed by the corresponding polymerized monomeric units M_k has a T_g of greater than or equal to 15°C.

3. A polymer according to claim 2, wherein said T_g has a value of greater than or equal to 20°C.

4. A polymer according to claim 1, wherein said homopolymer formed by the corresponding polymerized monomeric units M_j has a T_g of less than or equal to 5°C.

5. A polymer according to claim 4, wherein said Tg has a value of less than or equal to 0°C.
6. A polymer according to claim 1, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomers Mk is present in an amount ranging from 60 to 93 percent by weight relative to the total weight of the polymerized monomeric units Mi.
7. A polymer according to claim 6, wherein said amount ranges from 65 to 90 percent.
8. A polymer according to claim 1, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mj is present in an amount ranging from 7 to 40 percent by weight relative to the total weight of the polymerized monomeric units Mi.
9. A polymer according to claim 8, wherein said amount ranges from 10 to 35 percent.
10. A polymer according to claim 1, wherein said at least one of said branches has a form of a block and a molecular mass ranging from 500 to 2,000,000 Daltons.
11. A polymer according to claim 1, wherein n has a value ranging from 4 to 10.

12. A polymer according to claim 1, wherein said polymerized monomeric units Mk and Mj are independently chosen from radically polymerizable compounds containing an ethylenic unsaturation having a formula:



in which:

R₁, R₂, R₃, and R₄ are, each independently of one another, chosen from:

a hydrogen atom;

halogen atoms;

linear and branched alkyl radicals having from 1 to 20 carbon atoms

which are optionally substituted by at least one halogen atom or at least one

-OH radical;

linear and branched alkenyl and alkynyl radicals having from 2 to 10 carbon atoms which are optionally substituted by at least one halogen atom;

cyclic hydrocarbonaceous radicals having from 3 to 8 carbon atoms which are optionally substituted by at least one halogen atom, nitrogen atom, sulphur atom, or oxygen atom;

radicals chosen from CN, C(=Y)R⁵, C(=Y)NR⁶R⁷, YC(=Y)R⁵, cyclic NC(=Y)R⁵, SOR⁵, SO₂R⁵, OSO₂R⁵, NR⁶SO₂R⁵, PR⁵₂, P(=Y)R⁵₂, YPR⁵₂, YP(=Y)R⁵₂, NR⁸₂, NR⁸₃⁺, NR⁸₂(aryl)^{*}, and NR⁸₂(heterocycyl)^{*},

in which:

Y is chosen from O, S, and NR⁸;

R⁵ is chosen from linear and branched alkyl radicals, alkylthio radicals, and alkoxy radicals having from 1 to 20 carbon atoms; an OH radical; OM' radicals in which M' is chosen from alkali metals; aryloxy radicals; and heterocyclyloxy radical;

R⁶ and R⁷, independently of one another, are chosen from a hydrogen atom, linear and branched alkyl radicals having from 1 to 20 carbon atoms; or R⁶ and R⁷ together form an alkylene group having from 2 to 7 carbon atoms;

R⁸ is chosen from a hydrogen atom, linear and branched alkyl radicals having from 1 to 20 carbon atoms and an aryl radical;

COOR radicals, in which R is chosen from linear and branched alkyl radicals having from 1 to 20 carbon atoms which are optionally substituted by at least one halogen atom;

CONHR' radicals, in which R' is chosen from hydrogen atoms and saturated and unsaturated, linear and branched, hydrocarbonaceous radicals having from 1 to 20 carbon atoms which are optionally substituted by at least one halogen atom, nitrogen atom or oxygen atom;

OCOR" radicals, in which R" is chosen from hydrogen atoms and saturated and unsaturated, linear and branched, hydrocarbonaceous radicals having from 1 to 20 carbon atoms which are optionally substituted by at least one halogen atom, nitrogen atom, or oxygen atom; and
radicals comprising at least one silicon atom; or

R¹ and R³ radicals together form a ring having the formula (CH₂)_n which can be substituted by at least one halogen atom, oxygen atom, nitrogen atom, or an alkyl radical having from 1 to 6 carbon atoms, in which n' is an integer ranging from 3 to 12.

13. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkyl radicals having from 1 to 6 carbon atoms which are optionally substituted by at least one halogen atom or at least one -OH radical.

14. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkyl

radicals having from 1 to 4 carbon atoms which are optionally substituted by at least one halogen atom or at least one -OH radical.

15. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkenyl and alkynyl radicals having from 2 to 6 carbon atoms which are optionally substituted by at least one halogen atom.

16. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, are chosen from linear and branched alkenyl and alkynyl radicals having from 2 to 4 carbon atoms which are optionally substituted by at least one halogen atom.

17. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from C(=Y)R⁵, C(=Y)NR⁶R⁷, YC(=Y)R⁵, cyclic NC(=Y)R⁵, P(=Y)R⁵₂, YPR⁵₂, and YP(=Y)R⁵₂, in which Y is O.

18. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from C(=Y)NR⁶R⁷, in which R⁶ and R⁷ together form an alkylene group having from 2 to 5 carbon atoms.

19. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from COOR radicals, in which R is

13. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkyl radicals having from 1 to 6 carbon atoms which are optionally substituted by at least one halogen atom or at least one -OH radical.

14. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkyl radicals having from 1 to 4 carbon atoms which are optionally substituted by at least one halogen atom or at least one -OH radical.

15. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, is chosen from linear and branched alkenyl and alkynyl radicals having from 2 to 6 carbon atoms which are optionally substituted by at least one halogen atom.

16. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, each independently of one another, are chosen from linear and branched alkenyl and alkynyl radicals having from 2 to 4 carbon atoms which are optionally substituted by at least one halogen atom.

17. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from C(=Y)R⁵, C(=Y)NR⁶R⁷, YC(=Y)R⁵, cyclic NC(=Y)R⁵, P(=Y)R⁵₂, YPR⁵₂, and YP(=Y)R⁵₂, in which Y is O.

18. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from C(=Y)NR⁶R⁷, in which R⁶ and R⁷ together form an alkylene group having from 2 to 5 carbon atoms.

19. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from COOR radicals, in which R is chosen from linear and branched alkyl radicals having from 1 to 6 carbon atoms which are optionally substituted by at least one halogen atom.

20. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from CONHR' radicals, in which R' is chosen from hydrogen atoms, saturated and unsaturated, linear and branched, hydrocarbonaceous radicals having from 1 to 6 carbon atoms which are optionally substituted by at least one halogen atom, nitrogen atom or oxygen atom.

21. A polymer according to claim 12, wherein at least one of R₁, R₂, R₃, and R₄, independently of one another, is chosen from radicals containing at least one silicon atom, wherein said radicals are chosen from -R-siloxane radicals, -CONHR-siloxane radicals, -COOR-siloxane radicals, and -OCO-R-siloxane radicals, in which R is chosen from linear and branched alkyl, alkylthio, alkoxy, aryloxy, and heterocycloxy radicals having from 1 to 20 carbon atoms.

22. A polymer according to claim 1, wherein said polymerized monomeric units M_j and M_k are independently chosen from:

acrylic or methacrylic esters obtained from linear, branched, or cyclic aliphatic alcohols and/or from aromatic alcohols;

C₁-C₄ hydroxyalkyl (meth)acrylates;

ethylene glycol, diethylene glycol, and polyethylene glycol (meth)acrylates with a hydroxyl or ether end;

vinyl, allyl, methallyl esters obtained from linear or branched C₁-C₁₀ aliphatic alcohols, cyclic C₁-C₆ aliphatic alcohols, and aromatic alcohols;

N-vinylpyrrolidone; vinylcaprolactam; vinyl-N-alkylpyrroles having from 1 to 6 carbon atoms; vinyloxazoles; vinylthiazoles; vinylpyrimidines; vinylimidazoles; and vinyl ketones;

(meth)acrylamides obtained from linear, branched, or cyclic aliphatic amines or from aromatic amines; (meth)acrylamides chosen from acrylamide, methacrylamide and di(C₁-C₄)alkyl(meth)acrylamides;

olefins;

fluorinated or perfluorinated acrylic and vinyl monomers;

monomers containing an amine functional group in the free or else partially or completely neutralized or else partially or completely quaternized form;

carboxybetaines and sulphobetaines obtained by partial or complete quaternization of monomers containing at least one ethylenic unsaturation which contains an amine functional group, wherein said quaternization occurs by a sodium salt of a carboxylic acid which contains a mobile halide or by a cyclic sulphone; and silicone-containing (meth)acrylates and (meth)acrylamides.

23. A polymer according to claim 22, wherein said acrylic or methacrylic esters obtained from linear, branched, or cyclic aliphatic alcohols and/or from aromatic alcohols are obtained from C₁-C₂₀ alcohols.

24. A polymer according to claim 23, wherein said acrylic or methacrylic esters are chosen from methyl (meth)acrylates, ethyl (meth)acrylates, propyl (meth)acrylates, butyl (meth)acrylates, isobutyl (meth)acrylates, and tert-butyl (meth)acrylates.

25. A polymer according to claim 22, wherein said C₁-C₄ hydroxyalkyl (meth)acrylates are chosen from 2-hydroxyethyl (meth)acrylates and 2-hydroxypropyl (meth)acrylates.

26. A polymer according to claim 22, wherein said vinyl, allyl, and methallyl esters obtained from linear or branched C₁-C₁₀ aliphatic alcohols, cyclic C₁-C₆ aliphatic alcohols, and aromatic alcohols are obtained from C₁-C₆ alcohols.

27. A polymer according to claim 26, wherein said vinyl, allyl, and methallyl esters are chosen from vinyl acetate, vinyl propionate, vinyl benzoate, and vinyl tertbutylbenzoate.

28. A polymer according to claim 22, wherein said (meth)acrylamides obtained from linear, branched, or cyclic aliphatic amines or from aromatic amines are obtained from C₁-C₂₀ amines.

29. A polymer according to claim 28, wherein said (meth)acrylamides are chosen from tert-butylacrylamide.

30. A polymer according to claim 22, wherein said olefins are chosen from ethylene, propylene, styrene, and substituted styrene.

31. A polymer according to claim 22, wherein said fluorinated or perfluorinated acrylic and vinyl monomers are chosen from (meth)acrylic esters containing at least one perfluoroalkyl unit.

32. A polymer according to claim 22, wherein said monomers containing an amine functional group in the free or else partially or completely neutralized or else partially or completely quaternized form are chosen from dimethylaminoethyl (meth)acrylate, dimethylaminoethylmethacrylamide, vinylamine, vinylpyridine, and diallyldimethylammonium chloride.

33. A polymer according to claim 22, wherein said carboxybetaines and sulphobetaines obtained by partial or complete quaternization of monomers containing at least one ethylenic unsaturation which contains an amine functional group by a sodium salt of a carboxylic acid which contains a mobile halide or by a cyclic sulphone.

34. A polymer according to claim 33, further wherein said sodium salt of the carboxylic acid is sodium chloroacetate.

35. A polymer according to claim 33, further wherein said cyclic sulphone is propane sulphone.

36. A polymer according to claim 22, wherein said silicone-containing (meth)acrylates and (meth)acrylamides are chosen from (meth)acrylic esters containing at least one siloxane unit.

37. A polymer according to claim 1, wherein said polymerized monomeric units Mk and Mj are independently chosen from:

(meth)acrylic esters obtained from linear or branched aliphatic alcohols;
C₁-C₂₀ (meth)acrylic esters containing at least one perfluoroalkyl unit;
C₁-C₂₀ (meth)acrylic esters containing at least one siloxane unit;
(meth)acrylamides obtained from linear, branched, or cyclic aliphatic amines and/or from aromatic amines;

(meth)acrylamides chosen from acrylamides, di(C₁-C₄)alkyl(meth)acrylamides, and methacrylamides; vinyl, allyl, and methallyl esters obtained from linear or branched C₁-C₁₀ aliphatic alcohols and cyclic C₁-C₆ aliphatic alcohols; vinylcaprolactam; and styrene and substituted styrene.

38. A polymer according to claim 37, wherein said (meth)acrylic esters obtained from linear or branched aliphatic alcohols are obtained from C₁-C₂₀ alcohols.

39. A polymer according to claim 37, wherein said (meth)acrylamides are obtained from linear, branched, or cyclic aliphatic amines and/or from aromatic amines, and further wherein said aliphatic and/or aromatic amines are chosen from C₁-C₂₀ amines.

40. A polymer according to claim 37, wherein said (meth)acrylamides are chosen from tert-butylacrylamide.

41. A composition, comprising, in an acceptable medium, at least one polymer having a star structure chosen from structures of formula (I):

$$A-[(M1)_{p1}-(M2)_{p2}\dots(Mi)_{pi}]_n \quad (I)$$

in which:

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A is chosen from polyfunctional centers having a functionality n;

$[(M1)_{p1}-(M2)_{p2}\dots(Mi)_{pj}]$ represents a branch comprising at least one polymerized monomeric unit Mi having a polymerization index pj;

n is an integer greater than or equal to 2;

i is greater than or equal to 2;

pj is greater than or equal to 2;

the at least two branches may be identical or different; and

said at least two branches are grafted covalently to A;

wherein said at least one polymerized monomeric unit Mi comprised by at least one of said at least two branches is chosen from polymerized monomeric units Mk, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mk has a Tg of greater than or equal to 10°C; and

wherein said at least one polymerized monomeric unit Mi contained by at least one of said at least two branches is chosen from polymerized monomeric units Mj, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mj has a Tg of less than or equal to 10°C.

42. A composition according to claim 41, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mk is present in an amount ranging from 55 to 95 percent by weight relative to the total weight of the polymerized monomeric units Mi.

43. A composition according to claim 41, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mj is present in an amount ranging from 5 to 45 percent by weight relative to the total weight of the polymerized monomeric units Mi.

44. A composition according to claim 41, further comprising at least one agent which is able to form a film.

45. A composition according to claim 44, wherein said at least one agent is chosen from plasticizing agents and coalescence agents.

46. A composition according to claim 41, wherein said at least one polymer is present in an amount ranging from 1 to 95 percent by weight, on a dry basis, with respect to the total weight of said composition.

47. A composition according to claim 46, wherein the range is from 1 to 50 percent by weight.

48. A composition according to claim 46, wherein the range is from 1 to 20 percent by weight.

49. A composition according to claim 41, wherein said at least one polymer is present in said acceptable medium containing at least one phase chosen from aqueous phases, organic phases, and aqueous/organic phases.

50. A composition according to claim 49, wherein said at least one phase is chosen from alcoholic and aqueous/alcoholic phases.

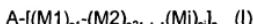
51. A composition according to claim 49, wherein said at least one polymer is dissolved or dispersed in said at least one phase.

52. A composition according to claim 41, wherein said composition has a form chosen from sprays, lacquers, foams, creams, gels, emulsions, lotions, and waxes.

53. A composition according to claim 41, wherein said composition has a form chosen from hair compositions.

54. A composition according to claim 53, wherein said form is a composition for treating and/or fixing the hair.

55. A process for retaining or shaping the hair, comprising applying to said hair a composition, comprising, in an acceptable medium, at least one polymer having a star structure chosen from structures of formula (I):



in which:

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A is chosen from polyfunctional centers having a functionality n;

$[(M1)_{p_1}-(M2)_{p_2}\dots(Mi)_{p_i}]$ represents a branch comprising at least one polymerized monomeric unit Mi having a polymerization index pj;

n is an integer greater than or equal to 2;

i is greater than or equal to 2;

pj is greater than or equal to 2;

the at least two branches may be identical or different; and

said at least two branches are grafted covalently to A;

wherein said at least one polymerized monomeric unit Mi comprised by at least one of said at least two branches is chosen from polymerized monomeric units Mk, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mk has a Tg of greater than or equal to 10°C; and

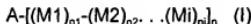
wherein said at least one polymerized monomeric unit Mi contained by at least one of said at least two branches is chosen from polymerized monomeric units Mj, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mj has a Tg of less than or equal to 10°C.

56. A process according to claim 55, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mk is present in an amount ranging from 55 to 95 percent by weight relative to the total weight of the polymerized monomeric units Mi.

57. A process according to claim 55, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mj is present in an amount ranging from 5 to 45 percent by weight relative to the total weight of the polymerized monomeric units Mi.

58. A process according to claim 55, wherein said hair is human hair.

59. A process for preparing a styling product, comprising introducing, in an acceptable medium, at least one polymer in an amount effective for retaining and/or shaping hair, wherein said at least one polymer having a star structure chosen from structures of formula (I):



in which:

A is chosen from polyfunctional centers having a functionality n;

$[(M1)_{p_1}-(M2)_{p_2} \dots (Mi)_{p_i}]$ represents a branch comprising at least one polymerized monomeric unit Mi having a polymerization index pi;

n is an integer greater than or equal to 2;

i is greater than or equal to 2;

pj is greater than or equal to 2;

the at least two branches may be identical or different; and

said at least two branches are grafted covalently to A;

wherein said at least one polymerized monomeric unit Mi comprised by at least one of said at least two branches is chosen from polymerized monomeric units Mk, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mk has a Tg of greater than or equal to 10°C; and

wherein said at least one polymerized monomeric unit Mi contained by at least one of said at least two branches is chosen from polymerized monomeric units Mj, which may be identical or different, wherein a homopolymer formed by the corresponding polymerized monomeric units Mj has a Tg of less than or equal to 10°C.

60. A process according to claim 59, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mk is present in an amount ranging from 55 to 95 percent by weight relative to the total weight of the polymerized monomeric units Mi.

61. A process according to claim 59, wherein said at least one polymerized monomeric unit Mi chosen from polymerized monomeric units Mj is present in an amount ranging from 5 to 45 percent by weight relative to the total weight of the polymerized monomeric units Mi.